



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2019/2020**

COURSE NAME : MATERIALS TESTING
COURSE CODE : BDB 40203
PROGRAMME CODE : BDD
EXAMINATION DATE : JULY 2020
DURATION : 3 HOURS
INSTRUCTION : ANSWER FIVE (5) QUESTIONS ONLY

THIS QUESTION PAPER CONSIST OF **THREE (3)** PAGES

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- Q1** (a) A metallurgist working in a steel plant suspected that some cracks are present in the cast billets from the continuous casting machine. The engineer has decided to use a magnetic particle testing method to inspect the defects. Explain the basic test sequence for magnetic particle test with illustration. (14 marks)
- (b) State TWO (2) advantages and TWO (2) disadvantages of radiographic method compared to liquid penetrant ion technique. (6 marks)
- Q2** (a) Determine the fundamental procedure for materials testing. (3 marks)
- (b) A circular aluminum tube of length $L = 450$ mm is loaded in compression by forces P . The outside and inside diameters are 65 mm and 50 mm, respectively. A strain gauge is placed on the outside of the bar to measure normal strains in the longitudinal direction.
- (i) If the measured strain is 500×10^{-6} , what is the shortening of the bar? (2 marks)
- (ii) If the compressive stress in the bar is intended to be 60 MPa, calculate the load P ? (3 marks)
- (c) Eddy Current testing is a NDT testing to evaluate surface and subsurface defects. Justify how Eddy Current testing can evaluate defects based on detected signal. (12 marks)
- Q3** (a) Differentiate THREE (3) properties of compressive behaviour for high and low ductility materials. (6 marks)
- (b) Justify FOUR (4) importance requirements for doing materials testing. (4 marks)
- (c) Fatigue failure is the failure of materials or structures under cyclic loading. There are two main factors affecting fatigue life of materials which are magnitude of stress and quality of the surface. Propose FOUR (4) solutions to overcome these factors. (10 marks)

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- Q4** (a) Write SIX (6) procedure in detail of the metallographic sample preparation. (6 marks)
- (b) Distinguish the major differences between Light Microscopy and Transmission Electron Microscopy (TEM). (4 marks)
- (c) Appraise the 'charging' phenomenon and the importance of conductive film coating on non-metallic specimen in the Scanning Electron Microscope (SEM) operation. (10 marks)
- Q5** (a) Compare between X-ray Powder Diffraction (XRD) and X-ray Fluorescence Spectrometry (XRF) in terms of their similarities and differences. (4 marks)
- (b) Illustrate the Fourier Transform Infrared Spectroscopy (FTIR) equipment and identify every parts of that equipment. (10 marks)
- (c) You have received two different powders having similar physical characteristic. Select the best method to differentiate their phases including a detail explanation of the method's principal. (6 marks)
- Q6** (a) Briefly explain what is thermal analysis. Explain the importance of thermal analysis in engineering. (4 marks)
- (b) Write THREE (3) applications of Therma Gravimetry Analysis (TGA). (6 marks)
- (c) Justify the mechanism of polymer structure at every different and exchanges of thermal by using a normal plot for thermal analysis of Differential Scanning Calorimeter (DSC). (10 marks)

- END OF QUESTIONS -